
DESCRIPTION

OF AN

ANOMALOUS ORIGIN OF THE RIGHT SUBCLAVIAN ARTERY,
ASSOCIATED WITH ANOMALIES OF ORIGIN OF
THE BRANCHES OF BOTH SUBCLAVIAN
ARTERIES; WITH REMARKS.

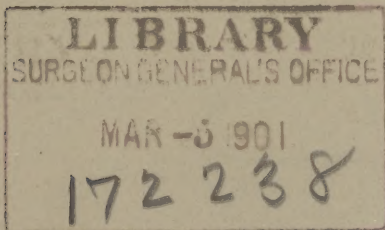
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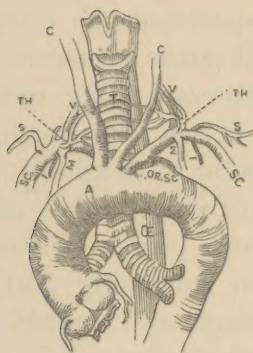
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ANOMALOUS ORIGIN OF RIGHT SUBCLAVIAN ARTERY.

THE specimen represented in the annexed drawing was prepared by me some years since—having come under my observation whilst engaged as assistant Demonstrator in the Jefferson Medical College anatomical rooms. Owing to the fact that the subject in which it occurred was dissected in parts, by students, it was impossible, at the time at which the anomalies were discovered,



to trace, with that accuracy which is so essential in all anatomical descriptions, the distribution of the vessels arising by anomalous points of origin from the subclavian arteries, or to determine the relations of the surrounding structures. It is believed, however, that the vessels can be designated with sufficient exactness to warrant a de-

scription of the specimen, by means of which it will be placed on record, with such other specimens of this character as have been already described.

The specimen presents, as will be recognized by reference to the figure, the following peculiarities:

1. Abnormal origin of the right subclavian artery.
2. As a necessary consequence of the first, an anomalous origin of the right primitive carotid artery.
3. Irregularity in the points of origin of the left primitive carotid, and left subclavian arteries.
4. Deviations from what is regarded as the normal plan of origin in the branches of the subclavian arteries.

The second and third conditions are incidental, and do not concern particularly the present investigations. The first and fourth are important, and may be described as follows:

1. ORIGIN AND COURSE OF THE RIGHT SUBCLAVIAN ARTERY.—In this specimen, the artery takes its origin from the superior and posterior aspect of the aorta on the left side, at a point corresponding to the junction of the transverse, with the descending portion of the arch, and one inch from the point of origin of the left subclavian artery. From this origin, it takes its course backward and obliquely upward, passes between the œsophagus and vertebral column, traversing portions of the second and first dorsal vertebræ, and reaches its normal position on the upper and outer surface of the first rib.

2. ORIGIN OF THE RIGHT PRIMITIVE CAROTID ARTERY.—This vessel occupies the place of the innominate artery, arising from its point of origin, from the commencement of the transverse portion of the aortic arch.

3. POSITIONS OF ORIGIN OF THE LEFT PRIMITIVE CAROTID AND LEFT SUBCLAVIAN ARTERIES.—The or-

igin of the former is in close connection with that of the right carotid artery, and in this respect occupies a position more to the right than is normal; in crossing to its distribution on the left side of the neck, it covers a larger surface of the trachea than is natural.

The left subclavian artery arises from the summit of the arch of the aorta—the middle point of the transverse portion of the arch, which is the normal point of origin of the left primitive carotid artery, deviating from its normal origin at the end of the transverse portion of the arch.

4. In the BRANCHES OF THE SUBCLAVIAN ARTERIES the deviations from the normal plan of origin are as follows: In both vessels the thyroid axis is absent—the branches originate as follows:

1. The *Inferior Thyroid Artery* on the right side arises independently from the first part of the subclavian artery at a point on the anterior surface and near to the *inferior* border.

On the left side, it arises independently from the anterior surface near the *superior* border from the first part of the subclavian artery.

2. The *Vertebral Artery* is smaller on the right side than on the left, and arises from the *superior* surface of the subclavian artery. On the left side, from the *superior* and *posterior* surface of the artery. On each side, it is given off normally from the first part of the subclavian artery.

3. The *Internal Mammary Artery*, on each side, takes origin from the anterior surface; on the right side, the point of origin is nearer to the inferior border, and in close connection with the points of origin of the *Inferior Thyroid*; on the left side, the distance between the two points of origin is greater.

4. The *Superior Intercostal Artery*, on the right side, originates from the upper and back part of the first portion of the subclavian artery to the inner side of the scalenus anticus muscle. The *Left Superior Intercostal Artery* arises from the posterior surface of the subclavian artery, near to the *inferior* border.

5. The *Transverse Cervical* and *Suprascapular Arteries* arise by a common trunk from the subclavian artery, at a point corresponding to the junction of the second and third portions of the artery, just external to the scalenus anticus muscle. On the right side the origin is from the upper surface; on the left side it is placed a little posterior.

6. In addition to the above-described branches, a small supernumerary artery arises on the right side—a muscular branch.

REMARKS.—The form of anomaly occurring in the origin of the right subclavian artery, as above described, has been so frequently observed and described as to divest this specimen of particular interest in this respect. In a very careful examination of a large number of authorities, I have not been able to find the description of a specimen illustrating this variety of anomaly, in which an association of anomalies in the origin of the branches of the subclavian arteries has been observed. The association of these anomalies of origin gives to the specimen, therefore, an interest which it otherwise would not possess, and will justify a more extended notice of it.

In examining the literature of this subject, my attention has been directed to some points in connection with the anomalies of this form which may be of interest to note. First, as to *frequency of occurrence*. Professor Joseph Leidy, of the University of Pennsylvania, informs

me that the Wister and Horner Museum contains, among its arterial preparations, at least three examples of this anomaly. In his dissections he has met with two instances. In all the examples which have fallen under his observation, the artery has passed behind the œsophagus. Dr. Wm. H. Pancoast, Demonstrator of Anatomy in the Jefferson Medical College, informs me that he has observed examples of this anomaly. Other instances may have been observed in the anatomical rooms, but, so far as I know, they have not been reported. Wood (*Trans. London Path. Society*, vol. x.), and other anatomists, state generally, that almost every museum contains a specimen showing this irregularity. Colles (*Surgical Anatomy*) states that he observed four instances in one winter's dissections—two in adults, and two in children. Quain (*Anatomy of the Arteries*) reports four instances as observed in the dissection of one thousand subjects, giving a proportion of one in about two hundred and fifty. J. M. Dubrueil (*Des Anomalies Artérielles*) states that it is remarkable “that among the inversions of the origin of the right subclavian artery, the most extraordinary in appearance is the most common; that in which the artery arises from the extreme left of the arch of the aorta, and reaches its normal position on the right side by passing behind the œsophagus.” He reports two instances in which this occurred—one especially noteworthy, in view of the fact that the *two primitive carotid arteries* accompanied the right subclavian artery in its abnormal course. It is thus described: “la sous-clavière droite, située en arrière et à gauche de sa congénère, et dirigée de bas en haut, passait derrière l'œsophage avec les carotides primitives.” Authorities generally agree as

to the frequency with which the right subclavian artery arises from the left side.

In reference to the *point of origin* of the right subclavian artery in these cases, there appears to be some variation. Wood alludes to the "singular constancy" of the abnormal point of origin of the right subclavian artery from the descending aorta, as noticed by Quain. Often it coincides with the very point of attachment of the ductus arteriosus. Messrs. Bankart, Pye-Smith, and Phillips (*Guy's Hospital Reports*, vol. xiv.) report two cases in which the artery arose from the "back of the third part of the aortic arch." Meckel (*Descriptive and Pathological Anatomy*) speaks of the right subclavian artery being the extreme left trunk of those which arise from the *arch of the aorta*, and passing to the right side behind the œsophagus.

Hyrtl (*Lehrbuch der Anatomie des Menschen*) vaguely describes the vessel as arising, in these instances, "below the left subclavian artery."

Cruveilhier (*Traité d'Anatomie Descriptive*) gives a similar description.

Harrison (*Surgical Anatomy of the Arteries*, p. 19) says that he has frequently found the artery arising distinctly from the descending portion of the aortic arch.

Quain, in opposition to the statement of Wood, as above quoted, declares that "the position which the artery under consideration (right subclavian) occupies on the aorta, when it springs on the left side, beyond all the other branches, is not constant. Thus, in some cases, it is seen to take rise from the upper part of the arch; in others, it is derived from the posterior aspect of the arch; lastly, the origin may be found much lower down, even from the descending aorta." In regard to the last, he

states that it probably "stands alone in respect to the depth at which the subclavian artery arises." Reference is made to anatomical plates containing drawings of specimens in which the different positions of origin are shown.

In the specimen under consideration, the point of origin is from the junction of the transverse with the descending portion of the arch. The weight of evidence seems to be in favor of the descending or third part of the aortic arch as the most frequent position of origin.

The *direction* which the artery takes is generally *oblique*, the obliquity varying in accordance with the position of origin of the vessel.

The *course* of the artery, in its passage from the abnormal point of origin to its position on the right side, is a question of much interest, relating to the constancy with which it passes behind the œsophagus, and to certain conditions which are described as attending its passage between the trachea and œsophagus. The latter will be referred to in another part of this article. Among the authorities consulted by me, Meckel, Cruveilhier, and Dubreuil alone speak of the passage of the artery in *front* of the trachea, and behind the other trunks given off from the arch of the aorta. The former says that it *rarely* passes in this course; the latter says that it *may* pass in front of the trachea. Neither alludes to cases in which this course was observed.

In reference to the passage of the artery between the trachea and the œsophagus, authorities agree that this variety is of extremely rare occurrence. Quain so speaks of it, and says further, that "it is often mentioned in treatises of anatomy; generally, however, without reference to particular cases." He refers to cases which are

reported to have fallen under the observation of Meckel, Monro, and Zagorsky, and states, as his opinion, that "it does not, in either case, appear clearly, from the written description or the figure, what the position of the vessel was with reference to the œsophagus." I have been able to collect three authenticated examples of this form of the anomaly. In one of the cases described by Messrs. Bankart, Pye-Smith, and Phillips (*Guy's Hospital Reports*, vol. xiv.), the artery took this unusual course. Dr. S. W. Gross informs me that an example of this kind came under his observation in the Jefferson Medical College dissecting-rooms during the past winter.

Dr. Bayford (*Memoirs of the Medical Society of London*, vol. ii. p. 275; 1793) gives the history of a case in which the artery was found to pass in this manner to the right side. Dubreuil quotes a case from Desault, *Journal of Surgery*, Paris, 1791, which he states was described in the *Memoirs of the Medical Society of London*, by Dr. Brewer. He remarks that the description was "very incomplete;" and it is questionable whether this is not a reference to Dr. Bayford's case alluded to above. On examination, I cannot find this case in the *Transactions of the Medical Society of London*.

RELATION OF THE RIGHT INFERIOR LARYNGEAL NERVE.—In all of these instances of anomalous origin of the right subclavian artery, the right inferior laryngeal nerve does not wind round it in proceeding to its distribution. A glance at the deep position of the artery will explain the cause of this. In its normal position, the artery is on a plane *anterior* to that of the larynx, and the pneumogastric nerve passes down in front, in close relation with the vessel. Just at the point of crossing, the inferior laryngeal branch is given off, and, in order to

reach the larynx *behind*, winds around the artery and ascends obliquely to the side of the trachea. When the artery passes *behind* the *oesophagus*, or *between* the *trachea* and *oesophagus*, it is placed deep behind the pneumogastric nerve, and on a plane *posterior* to the larynx; the inferior laryngeal branch, therefore, although given off at the normal point of origin, goes directly to its distribution.

G. W. Stedman (*Edinburgh Medical and Surgical Journal*, vol. xix., Oct. 1823) relates a case of "singular distribution of some of the nerves and arteries in the neck and the top of the thorax." The right subclavian came off from the left side of the arch of the aorta. He states that he could not find the recurrent laryngeal nerve, and thinks that it was absent, its duty being performed by branches given off from the trunk of the pneumogastric.

John Hart (*Ibid.*, April, 1826) describes "a case of irregular origin and course of the subclavian artery, and right inferior laryngeal nerve." The artery originated as in the case above, and the nervus vagus of right side crossed the subclavian artery without giving off recurrent nerve in usual manner." "The office of this nerve was, however, performed by several branches arising from inner side of trunk of nervus vagus; the highest and largest became by its distribution the inferior laryngeal nerve." He explains the failure of the inferior laryngeal nerve to wind round the subclavian artery in these cases, by referring to the earlier periods of the existence of the fœtus, when the larynx is placed behind the ascending portion of the arch of the aorta, whilst the brain rests on the thymus gland and in front of the ascending portion of the aortic arch. The inferior laryngeal nerves pass back to the larynx, the left going through the arch of the aorta, and the right below the arteria innominata. As

gestation advances, the neck lengthens, and the brain is removed upward, in accommodation to which the nerves become elongated, suspending the arch of the aorta and the right subclavian artery in loops. When the right subclavian arises on the left side, it passes behind the larynx, and is, therefore, not embraced by the inferior laryngeal nerve.

The absence of the right inferior laryngeal nerve is not mentioned as usually occurring in these examples. In the specimen under consideration no abnormal condition of the nerve was observed.

Compression of the œsophagus by the artery, producing a condition of *dysphagia*, has been observed. The only well-authenticated case on record, in which this condition existed, associated with an abnormal origin of the artery, is that of Dr. Bayford (*op. cit.*):

“The patient, a female aged about sixty-two, had been subject to difficulty of swallowing from the earliest age. The difficulty increased at the period of puberty, and became periodically aggravated; exercise, or any cause tending to accelerate the circulation, increased the distress; abstraction of blood afforded relief. The pain and the seat of the obstruction were referred to the upper part of the sternum. She finally died, exhausted by fatigue and famine. On making an examination after death, nothing could be found to account for the condition, except the position of the artery between the trachea and œsophagus, and from the obvious connection between the state of the circulation and the symptoms, it was reasonably concluded that the vessel was the source of these.”

Dr. Bayford gave the name of “*dysphagia lusoria*” to the disease, which he was the first to describe, in accordance with the general belief that all departures from the

usual arrangements of organs were examples of a "lusus naturæ." Quain thinks that this condition exists only in those cases in which the artery passes between the trachea and œsophagus. Other cases of dysphagia are recorded, in which the artery was found to pass behind the œsophagus. Careful examination of the reports, however, shows that the symptoms were not such as to warrant the conclusions drawn.

In the great majority of the cases in which the artery was found to pass behind the œsophagus, no history of dysphagia was given. Professor Otto (*Seltene Beobachtungen*, Th. 1, S. 100) reports a case in which he had an opportunity to observe a patient for more than one month, in whom this position of the artery was found, after death, to exist; there was no dysphagia whatever. So far as I can ascertain, no explanation is offered to account for the occurrence of dysphagia in the one case and not in the other. A careful examination of the normal position and relations of the œsophagus, and of the abnormal position and relations it assumes under the influence of the abnormal origin and course of the artery, induces me to submit the following explanation. The œsophagus, at its commencement in the neck, lies immediately *behind* the trachea. As it enters the thorax, it is directed to the left of the median line, emerging from its position immediately *behind* the trachea, and passes across the *left side* of the transverse part of the aortic arch, descending in the posterior mediastinum on its way to terminate at the cardiac orifice of the stomach. Between the transverse part of the aortic arch, which rests in *front* of the trachea and the œsophagus, there exists a space equal in distance to the depth of the trachea. When the right subclavian artery takes origin from the extreme end of the transverse

portion of the arch, or from the junction of the transverse with the descending portion of the arch, or, again, from the descending portion itself, it forms the outer lateral boundary of a triangular space of which the transverse portion of the arch in front, and the trachea on the side, form the other boundaries. In the specimen under consideration, the antero-posterior diameter of this space is fully one inch; the transverse diameter is three-quarters of an inch, affording therefore a space in which the tube rests without being subjected to any constricting pressure. The artery in passing behind the tube forces it forward into this space, and the distention caused by a morsel of food is in this direction, where ample room exists.

When, on the contrary, the artery takes the more unusual course between the trachea and œsophagus, the latter is compressed against the unyielding vertebral column behind, and in front the artery has the rigid tracheal tube upon which it can exert no force.

During inaction of the œsophagus, the artery has sufficient space, and no interruption is offered to the circulation. Upon the introduction of food into the œsophagus, the bolus meets with a constriction at this point, which it is, however, able to overcome, but at the expense of forcing the artery against the trachea, and making such pressure upon it as will materially interfere with the blood-current. This sudden interruption of the circulation in a large artery, so near to the great column of blood in the aorta, must cause serious disturbance in the circulating mass, and induce that condition of feeling so graphically described by Dr. Bayford's patient as the near approach of the "agony of death."

It will be observed that the usual symptoms attending stricture of the œsophagus, such as regurgitation of food,

etc., are absent, only those being present which relate to disturbance of circulation, and through this the evil effect is produced.

This explanation, it appears to me, is in strict conformity with the anatomical relations of the parts, and, if any other has been suggested, this may be worthy of being considered in connection with it.

While the œsophagus has such ample latitude in the space above described, I can still conceive that an accident, such as Mr. Kirby records in the second volume of the *Dublin Hospital Reports*, may occur. In this case, a bone, which had been swallowed, was stopped opposite to the point at which the artery crossed behind the œsophagus, perforated the tube, and wounded the artery, causing fatal hemorrhage.

SURGICAL ANATOMY.—In discussing this form of anomaly, writers have very properly directed attention to the relations of the artery in the first part of its course—that is, before it reaches the inner border of the scalenus anticus muscle. Sometimes it is necessary to apply a ligature on this part, and it should be borne in mind that, in these instances, the vessel lies *behind* the right primitive carotid and very deep, separated by fascia and adipose tissue. The *Lancet* for 1839 contains the report of a case in which Mr. Liston performed ligation of the right subclavian artery in the first part, for aneurism. He experienced great difficulty in finding the artery, which was placed behind the carotid to the distance of full one-half an inch, and was separated from it by fascia and adipose tissue. Quain, who was present, thought, from the depth of the result, that it was an instance of this kind. No post-mortem examination was reported to have been

made, by means of which the exact condition could be determined.

I have been interested in observing that the great proportion of examples of this anomaly have occurred in females. Over two-thirds of the cases, in which the sex was given, were observed in females.

LEFT-HANDEDNESS.—Hyrtl states that Prof. Oehl, of Pavia, found, in two cases of this kind, that the individual was left-handed, and he gives, as a possible explanation of this condition, the fact, that, owing to the transposition of the origin of the vessel, a feebleness of circulation is given to the right extremity. The question is interesting and worthy to be noted.

BRANCHES OF THE SUBCLAVIAN ARTERIES.—Absence of the thyroid axis is noted to occur quite frequently. In the majority of instances, the branches of the thyroid axis arise independently from the first portion of the subclavian artery, less frequently from the second and third portion. In a number of instances, the suprascapular and transverse cervical are recorded as taking origin by a common trunk, as in this specimen. This latter deviation is to be remembered as important in surgical operations performed upon the third portion of the subclavian artery.